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FOREST SERVICE

BRANCH OF RESEARCH

MONTHLY REPORT

OF

FOREST EXPERIMENT STATIONS

FOREST PRODUCTS

FOREST ECONOMICS

RANGE RESEARCH

SEP 1933



BRANCH OF RESEARCH

September, 1933.

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ALLEGHENY FOREST EXPERIMENT STATION

General

Civilian Conservation Corps assistance at the Kane Experimental Forest has made it possible to place additional weather instruments, to expedite sample plot work, to mark compartment boundaries, to complete walks and grading around the headquarters buildings, to establish an intensive system of fire breaks and other lines of communication, and to prepare a 5-acre site for planting next spring with Norway pine from Bates' pedigreed stock.

A field trip to southwestern Pennsylvania taken by the Director in company with Dr. Rodney H. True, head of the botany department of the University of Pennsylvania, Dr. E. E. Wildman, supervisor of natural science instruction in the Philadelphia Public Schools, and Mr. A. B. Ross, originator of the farm demonstration agent idea in the United States, opened new channels for thought. Mr. Ross has a plan for the production of "farmed timber" as a part of farm management in southwestern Pennsylvania. He believes that many hill farms, intrinsically capable of yielding a living to their owners, are being unnecessarily abandoned because of mismanagement. One factor in this mismanagement is the attempt to work more than 40 acres with one team, and the idleness of that team during the winter. He proposes to cut the cultivated and pastured acreage to what can be properly handled, and to plant fast-growing trees on the balance. By preparing the planting site thoroughly, using nitrogen-fixing locust or other forest legumes to supply fertility, and cleaning and thinning the young plantations systematically, he hopes to raise pulpwood, mine props, etc., on rotations of not over 15 years.

Management

Wood has spent the summer working alone at Camp Ockanickon. Intensive weather and soil measurements, besides stem and root observations of seedlings under a variety of controlled conditions, have been made. Wood devised a shade screen mounted on rollers, which can easily be moved on or off the seed beds by one man. Further root excavation delayed by lack of funds, is now under way. The second of the two chestnut oak saplings cut in April finally sprouted vigorously, and its roots may show some interesting contrasts with the one which sprouted promptly.

The tropical storm which visited New Jersey on August 21, 22, and 23 left 8.10 inches of rain. The normal yearly precipitation for Camp Ockanickon - about 44 inches per year - has already been exceeded. We have yet to report "normal" weather conditions at this branch station.

The data obtained on the Little Arnot method-of-cutting plots on the Allegheny Forest were summarized as an aid to the E. C. W. in stand improvement. It is now 6 years since the plots were cut, and the reproduction is just beginning to over-top the blackberry bushes.

We have approached most prayerfully the problem of laying out a series of stand-improvement plots on the Kane Forest. We first visited the only available examples of stand improvement work in the Northern hardwoods type: the very recent and necessarily extensive girdlings of wolf trees (mostly) made by the C. C. C.; an experimental diameter limit cutting made 3 years ago by Mr. E. O. Ehrhart of our Advisory Council, on a tenth-acre plot owned by the Armstrong Forest Company (Curtis Publishing Company); and a woodland thinned during the last 15 years by its former owners, who cut one or two stems out of crowded sprout clumps, without - apparently - greatly promoting either growth or rot in the remaining stems. We next examined the Experimental Forest, compartment by compartment, to see what forest condition was most commonly in need of treatment and then checked our conclusion against the opinion of Forest Supervisor Bishop and Mr. Vessey, in charge of C. C. C. cultural operations on the Allegheny Forest, who were familiar with conditions on the Forest as a whole. Bishop felt strongly that precedence should be given to work in stands from which an average of not less than ten cords per acre can be removed in improvement cuttings; elsewhere the cutting can hardly be made to pay for itself.

Accepting this idea, without of course excluding from future experimentation stands which may require an actual investment in cleaning or thinning, Forbes, Hough, Ackerman, and McComb laid out two plots in a 40-year old stand containing so many defective hold-overs from the original forest, and so many misshapen, catfaced, and dead trees in the second growth, that well over 10 cords per acre required removal. The black cherry, unquestionably the most valuable species and of very rapid growth, was badly forked. Porcupines several years ago had exposed the wood at the base of a great many trees of all species, and increment borings revealed more or less rot. The 1930 and 1931 droughts had decimated the stand. All in all the forest was in rather appalling condition, and the improvement cutting will in places unquestionably result in reproduction and in the conversion of the more or less even-aged stand into an all-aged one. Eight half-acre plots, in two Latin squares without isolation strips, were finally laid out, and the marked trees on four plots will be cut for fuel by local people.

A somewhat younger stand, or one at least having fewer hold-over trees, was selected for another set of plots. Even here silvicultural considerations dictated marking over ten cords per acre, and more than one degree of thinning or other improvement cutting was hard to justify. To this extent the problem of marking is simpler than we had expected; on the other hand we feel that marking in this type will always require a high degree of common sense and technical skill, and cannot be so simplified that anyone short of a skilful forester can handle it.

Mensuration

Good progress has been made on tabulating the 30,000 loblolly pine individual tree records of the Maryland plots obtained during the past 25 years. These are to be punched and sorted by machine. It is planned to study the development and growth of these stands, and perhaps answer many perplexing questions concerning mortality and growth. We hope also to reach some conclusions as to the value of individual tree records in such studies.

The oak yield analysis is completed, and Schnur returned to Philadelphia to start work on the manuscript. Density was found to be a more important factor than species composition, even though the plots are thought to be normal. A total cubic foot yield alignment chart, using age, site, and density as independent variables, was readily constructed by Bruce's method of multiple curvilinear correlation.

Schnur made a start on the analysis of his 1930 drought damage study in central Pennsylvania.

APPALACHIAN FOREST EXPERIMENT STATION

General

The meeting of the Appalachian Forest Research Council, usually held in June, was postponed because of E. C. W. and other field activities of the Station staff. Unless the Nira construction and research projects now being started make too heavy demands upon the time of the staff the meeting will be held during the late fall or winter.

The Bent Creek field laboratory continued to serve as a center for visiting forestry students and their professors. In addition to several groups who visited the laboratory this spring, a party of Pennsylvania State students under the leadership of Professor Cope and White spent several days there in July, and a small party from Florida made a brief visit.

E. C. W. and Nira activities

Various members of the staff visited C. C. C. camps in North Carolina, Georgia, and West Virginia. Very material assistance in sample plot remeasurement at Lookingglass Rock, Pisgah National Forest, and in miscellaneous work on the Toccoa and Fernow Experimental Forests was contributed by the E. C. W. forces through the loan of the services of the cultural foremen (Vernon Hicks on the Fernow, and Ernst Brender on the Toccoa) and enrolled men.

On the Toccoa Experimental Forest, E. V. Brender, a cultural foreman on the Cherokee National Forest, was assigned to the Experiment Station and under supervision of Barrett has been proceeding with the boundary survey of the Toccoa Experimental Forest, using a crew of five to six C. C. C. men on the work. Boundary signs are being posted and permanent control stakes for the forest inventory are being set as the lines are surveyed.

On the Fernow Experimental Forest, Vernon Hicks, cultural foreman

on the Monongahela National Forest, worked with a crew of enrolled men replacing temporary with permanent markers on line plots established by the Abells and Mr. Hedges in their survey of the area. In connection with this work Hicks took data for the location of contour intervals on the map of the area previously prepared by Abell.

Plans for Nira expenditures contemplate the construction of small groups of buildings and other improvements on the Bent Creek, Fernow, Toccoa, and Coweeta Experimental Forests, as well as on the proposed experimental areas in Kentucky and South Carolina. Through the cooperation of Supervisors John Byrne of the Nantahala National Forest and Arthur Wood of the Monongahela, E. C. W. roads to the Coweeta and Fernow Experimental Forests are already under construction. Further work on roads and trails penetrating all the experimental forests will be done under Devnira funds.

Forest management investigations (mountain region)

The sample plots established at Lookingglass Rock, Pisgah National Forest, in 1923, for the release of yellow poplar reproduction from heavy overhead shade were remeasured in August. Since the last five-year examination, in 1928, accessions to sizes above 1.6 inches, d.b.h., averaged 585 trees per acre on the treated plots and 343 on the untreated plots, the increase in the latter instance being due, at least in part, to the occurrence of openings caused by the death of chestnut sprouts from the blight. Yellow poplar and black locust are growing together on these plots and for the first ten-year period the locust has grown more rapidly in height. The poplar is now catching up and bids fair soon to overtop the locust completely.

A new set of cleaning plots in five-year-old young growth cove hardwoods is being established on Stony Fork, Pisgah National Forest. Methods of releasing crop trees now being used in C. C. C. cultural operations are being compared with both less and more intensive methods of crop tree release. In all, seven different treatments and checks are being established. Each treatment is being duplicated four times on tenth acre subplots distributed over the area. A total of 28 subplots is being treated with four subplots reserved as checks. The plot will serve not only as a follow-up of the present C. C. C. cultural operations, but will be helpful as a guide in future sale area improvement work.

At the north Georgia branch station, bi-monthly examinations of the yellow poplar seed bed treatment quadrats at Blairsville were made during the early summer. Germination occurred over a period of thirteen weeks, beginning the first week in May. However, the bulk of the germination took place the last three weeks in May. Even where reaction was most favorable to the various seed bed conditions, germination was far below that determined by greenhouse tests for the same lot of seed. Cutting tests of seed in the quadrats showed that it was still apparently in good condition and probably holding over until next year.

Management studies (Coastal Plain)

Data obtained in a study of several methods of stratifying loblolly pine seed were analyzed. The results indicated that stratification for from one to three months in a commercial ice house in moist sand or moist

peat, gave the greatest germination in the shortest time after planting. Storage in dry sand or peat in the ice house and in either moist or dry media in a spring house or at ordinary room temperatures was less satisfactory.

Fire damage studies (Mountain region)

The fifteen acre plot on the Bent Creek Forest, experimentally burned in December 1932, was reexamined during the summer. The order of susceptibility to fire damage of the less desirable species was found to be as follows:

Crown injury- - -dogwood, black gum, sourwood, hickory.

Basal injury- - -red maple, dogwood, sourwood, black gum.

The sprout growth which occurred as a result of the fire was heavily browsed by deer. Black gum was most heavily browsed, followed by sourwood, yellow poplar, red maple, hickory, the oaks, dogwood, and locust.

Preliminary dye injections on fire-wounded scarlet oaks were started on this plot to determine the effect of such wounds on water conduction. In some cases where roots beneath wounds were injected it was found that conducting elements between the root and the margin of the callus had been laid down during the current year's growth at extreme angles from the old. Apparently, injured scarlet oaks are able to utilize roots beneath wounds to some extent, provided the lateral distances between the margins of the wounds and the roots are not too great. In the experiment reported, the critical distance appeared to be about four inches.

A series of four half-acre plots in a mixed pine-oak stand at Bent Creek were examined for mortality. One of these plots was experimentally burned in April 1930, one has had the litter removed by raking each year, and two have been held without treatment as checks. The accumulated mortality on the burned plots amounts to almost ten times that on the control plots. On the burned plot 107 hardwoods (214 per acre) have died since the fire while only 26 hardwoods have died on the two control plots (total area 1 acre). Mortality on the raked plot was slightly lower than on the untreated check areas.

The effects of the fire on pine mortality are obscured by mortality resulting from an infestation of southern pine beetles. The infestation began on the burned plot shortly after the fire and spread to the adjacent control plots.

Fire studies (Coastal Plain)

Data on the effects of three annual fires on growth of longleaf pine at Lanes, S. C., were analyzed. The results of the analysis showed a very striking reduction in growth associated with the annual fires. Trees on the annually burned plots grew 42 percent less in basal area than those on the unburned plots.

Streamflow-erosion studies

Plot studies of the comparative efficiency of certain types of vegetative cover are being continued at Bent Creek. The stormflow from these plots, which represent five common cover types, is being measured as surface run-off and also as subsurface flow at twelve inches. A summary showing the nature of the storms and a record of the stormflow during the year ending June 30, 1933, was prepared and inserted, in part, in the Station's current annual report. Sixty-six rain storms and two snow storms occurred during this period. From these data it appears that old-field pine stands effectively control surface run-off and that on the areas studied a natural grass cover such as broomsedge is effective in controlling both erosion and excessive stormflow. On the other hand, the surface run-off from the floor of an oak-pine forest from which the litter has been removed for the past three seasons was from 10 to 20 times that from adjacent undisturbed control areas. The surface run-off from an oak-chestnut sample plot experimentally burned in the fire damage study was considerably increased as a result of the burning, particularly on slopes of 40 percent or more.

Forest insect investigations

Entomological investigations conducted in the vicinity of Asheville during the summer of 1933 centered, as in the past, primarily around the southern pine beetle, and especially its control by tree injection.

Injections in previous years were made principally to discover chemicals effective in controlling broods of the barkbeetles. Several suitable chemicals were found but the method of application then in use proved impractical on large trees.

In order to apply the favorable experimental results obtained it was thought best that during 1933 emphasis should be placed on attempts to put tree injection on a practical basis. Considerable attention was also given to the possibility of finding a chemical and a method whereby it could be injected to kill the barkbeetles and yet save the tree.

In addition to injection work, several new chemicals were tested for the prevention of attack and control of insects by means of spraying and dipping.

The personnel for the past summer included Mr. R. A. St. George, Dr. A. Gordon, and B. J. Huckenpahler. Work was begun around June 20, and continued to the end of August. Dr. Gordon has been working in the West on the problems of saving esthetically valuable trees.

The following are some of the results obtained:

1. In connection with injecting trees by the saw-kerf method, chemical substances, cements, airplane dope, etc., used as a banding material proved impractical.
2. Of all mechanical bandages, stapling a solid heavy rubber strip

1 1/2" x 3/4", with a durometer reading of 20-30 over the cut, proved to be most satisfactory for use on a large scale operation.

3. The difficulty of controlling the southern pine beetle in virgin timber by injection was further emphasized by the treatment of 60 large trees apparently in a favorable condition but later proved to be too long attacked.

4. Two chemicals were found which apparently are non-toxic to the phloem and foliage and therefore have possibilities in saving pine trees of esthetic value. Its effect on the barkbeetles and blue stain must, however, be investigated.

5. Several healthy pine and oak trees were injected with ammonium copper arsenite to note its preservative qualities.

6. After three years' service tests pine and oak trees injected with mercuric chloride are still very sound and free from insect attack. Two arsenic compounds exhibit nearly the same preservative qualities.

7. Some of the penetrating oils tested by spraying proved to be effective in controlling barkbeetles and borers in pine logs. Such a method eliminates the necessity of destroying the brood by burning.

8. An experiment was begun to note the effect of dipping hickory billets, infested with *Lyctus* powder-post beetles, in chemical substances.

Biological activities

Shortly after the first of August inspection of cultural cuttings carried on by C. C. C. camps on the seven National Forests in the southeastern states was started by Burleigh in company with Major E. A. Goldman, and it was the end of September before this work was finished. This inspection was undertaken at the suggestion of the Washington Office of the Forest Service to determine the possible effect of this thinning on the wild life of this region.

Forest Pathology

During September the Office of Forest Pathology, of the Bureau of Plant Industry, began studies at their laboratory at the Appalachian Forest Experiment Station, on the pine canker disease, caused by *Atropellis pinicola*, and the *Nectria* canker disease of hardwoods. Dr. M. L. Lohman and Mr. J. D. Diller are assigned to the pine canker disease work, and Dr. G. H. Hepting and Mr. F. G. Liming are assigned to the *Nectria* canker work. Field studies are also being conducted in conjunction with the Civilian Conservation Corps.

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CALIFORNIA FOREST EXPERIMENT STATION

General

The California Station has been forced to top speed and has suffered severe dislocations of program by the drastic reductions in regular allotments and the constant new developments in emergency programs.

The fire staff has given heavy time during the summer to the E.C.W. revision of the National Forests lookout lay-outs. Wieslander has suffered serious interference with the needs of an already increased burden in his type map supervision by having to take on, with an RO representative, the scouting and location of an 800 mile fireline down the whole front of the Sierras for E.C.W. winter construction. Dunning and Brundage's work in laying out road systems on experimental forests, and with Talbot in planning headquarters for them, while a future Station asset of large proportions, has shelved quantities of regularly programmed work with serious disadvantage. Talbot and Hill have made heavy contributions to Station time, especially in connection with prospective personnel.

Fire research has lost its chief, Gowen, by his return to a Forest Supervisorship; Products has lost its junior staff member, Mason, to R-6; and now Lowdermilk, in charge of erosion-streamflow, leaves to help direct national NRA work in erosion control.

During the summer the Station experimental forests in this Region have been augmented. The Black Mountain (Lassen National Forest) and the Feather River area (Plumas National Forest) have received approval of the Region with definite boundaries, and await Washington approval. The Swayne Mountain area (Lassen) has been approved by the Region on tentative boundaries and desired final boundaries have been indicated by the Station.

Forest Management - Pine Region

The methods-of-cutting plots on the Stanislaus and Plumas were re-measured, and permanent hypsometer hubs set. The cruise of one 160-acre plot showed that heaviest losses during the past year occurred in white fir, due almost entirely to the white fir engraver beetle (Scolytus ventralis). Losses in other species were confined largely to suppression.

Some of the permanent yield plots were remeasured. A total of 75 temporary yield plots were taken in even-aged second growth ponderosa pine stands distributed between the Stanislaus and Shasta Forests. One measured 28.8 inches at b.h., and 99 feet total height - 36 years total age. A considerable area of pure even-aged sugar pine in the 70-year age-class was found.

The annual remapping was done on 246 milacre reproduction quadrats, on 118 of which all vegetation was mapped. Very few new seedlings were found.

At the Stanislaus Branch growth started in sugar pine and incense cedar about May 29. Jeffrey pine growth started before May 20, but was at a standstill for the two weeks following due to a cold spell. Ponderosa pine was well started by June 1. White fir had not then started. Lodgepole pine made the most rapid early growth of any species, two trees starting growth before April 10.

Good seed germination was secured in the seed beds and screened seed spots. White fir germinated earlier on south slopes than on north slopes, but frosts caused heavy losses on the south slopes. These frosts came before seed had germinated on north slopes and may account partly for the prevalence of white fir on north slopes. Sugar pine was more resistant to frost than white fir. White-footed mice gained entrance to one seed bed and showed a marked preference for white fir over sugar pine.

Wilting coefficient determinations were made for soil samples from the site factor station area by use of potted wheat plants,

Seed counts were made on all trees bearing seed, except incense cedar, for five of the Stanislaus plots. Ponderosa pine had a heavy crop of cones, sugar pine had a moderate crop, and white fir a light crop. Trees on the heavily cut woods-and-mill plot bore very few cones as practically no Class 3 or large Class 1 trees were left after cutting.

The mapping-inventory crew ran control for the Feather River and Black Mountain experimental areas, and are now cruising and mapping the Black Mountain area. On this area a 100% cruise is being made of all trees 3.6 inches d.b.h. and over, with a tally of smaller trees on groups of four milacre plots taken at 2 1/2 chain intervals along cruise lines run five chains apart. Trees for a salvage cutting are tallied and graded when merchantable. Measurements for site-class determination and height-diameter curves are taken at 10-chain intervals along the cruise lines. Timber, reproduction, shrub, and other types are mapped in detail. The grazing crew is taking data on stock damage to reproduction, and on herbaceous and shrubby vegetation.

On the Stanislaus from 6 to 12 C. C. men have been working since August 9 on sugar pine release cutting. Considerable sugar pine reproduction became established on the area about 30 years ago, along with ponderosa pine, white fir, and incense cedar. At present most of the sugar pines are in the intermediate or suppressed crown classes within clumps of white fir, incense cedar, and some ponderosa pine. Some have already been killed by suppression. The work consists of cutting all white fir and incense cedar within roughly six feet of sugar pines which are likely to develop into dominants after release. Ponderosa pines are not being cut. A complete record of costs in man-hours has been kept.

Forest Management - Redwood Region

Field work on the redwood studies was carried on with little interruption from early in May until the middle of September. This work has been concentrated in the operating areas of Humboldt and Mendocino counties.

The study of silvicultural damage from logging was given high priority. We now have a record of one to three examinations for each of 50 one-acre plots representing a variety of conditions on the logging areas of five of the largest redwood operating companies. The principal factors considered are: method of logging, stand density, exposure, slope gradient, position on slope, and position in relation to the landing. Thirty of these plots have received final examination after logging. Examinations are made before chopping, after chopping and after yarding. It is hoped to obtain data on some of the factors affecting destructiveness of slash fires this fall. It is evident, that the protection of seed trees and other "leave" trees from destructive yarding practices and slash fires will necessitate radical changes in present logging methods. All yarding methods studied are excessively destructive with the exception of "cat" logging; and broadcast slash fires usually kill any trees which escape yarding damage.

Field work on the effectiveness of seed trees and redwood "fire columns" was completed and this material will be incorporated into the report on the condition of redwood cut-over areas which was nearly completed last year. It was found that "fire columns" are generally ineffective in seeding in cut-over areas because they do not produce much seed until at least six or seven years after being burned. This allows too long a period for the development of brush and other vegetation which make conditions unfavorable for the establishment of redwood seedlings.

Hallin has made a good start on the study of redwood site and yield. In addition to 14 yield plots in normal stands from 33 to 70 years of age, sprout clumps from 4 to 25 years of age were studied in an attempt to correlate site quality with average height of redwood sprouts. If this method proves practicable it will make possible the determination of site on areas with second growth under twenty years of age, which is the minimum for the yield tables worked out by Bruce.

Range Research

In the foothills the time of the range group was mainly utilized in examining plots, recording forage utilization, chartographing quadrats, type-mapping a 10-acre enclosure, recording data on one burn, analyzing selected classes of precipitation data, analyzing 1933 forage data, and examining foothill tracts of national forest, public domain and private lands as work center possibilities and preparing a purchase-case report on private land.

Highlights of foothill findings

1. Plot examinations. The last two (5th and 6th) regular plot examinations were completed in the early parts of May and June. A seventh examination was made in the first week of September to have on record the condition of the foothill ranges in the middle of the dry-forage period.

A set of the most important foothill grasses was collected and mounted on an exhibit panel for use in discussions with stockmen and other interested persons.

2. Utilization notes. Supplementing the regular plot notes, data were recorded on the utilization of forage species at different stages of development. Three methods were employed.

- a. Livestock were followed and direct observations were made on the amount and kind of forage taken.
- b. Fields in which stock were grazing were examined for evidence of utilization.
- c. Comparisons were made in adjoining areas, one of which was grazed and the other ungrazed.

Notes included the date, class of stock, plant species grazed and their stage of development. Compilations have not been started.

3. Quadrat charting. Poa scabrella is probably the most important perennial grass in the foothills. The presence of this species on the Clark Administrative Site, a detached tract of 160 acres of national forest land, made possible the establishment of four chart quadrats on the area on which to begin a study of the grass under protected and grazed conditions. Two quadrats were located on grazed range, two on ungrazed.

4. Type map of 10-acre enclosure. It was deemed desirable to have on record the condition of the vegetation in the enclosure on the Clark tract at the time of fencing. Therefore a type map of the area showing the boundaries and composition of the tree and browse groups, and composition write-ups of the herbaceous vegetation were completed. Previous convictions of the impossibility of establishing definite sub-type boundaries in herbaceous vegetation over large foothill areas, were supported by this mapping. Except for small families or colonies of plants the vegetation is too uniform in composition and aspect for subtyping.

5. Transects on burned areas. The Clark tract also afforded the opportunity to observe in an initial way some phases of the fire problem in the foothills. Two transects, 13 and 21 meters long, each transversing burned and unburned areas, were mapped and notes were taken on each. These transects are expected to point out difficulties of experimental attack as well as some of the conspicuous effects of fire in the foothills.

6. Precipitation trends in the foothills. Data from 19 selected Weather Bureau stations representing the foothills fronting the Stanislaus, Sierra, and Sequoia national forests were used for precipitation analysis. Some of the highlights obtained to date follow:

- a. The average length of record for the 19 stations was 26 years. Fifteen stations have kept records for 20 years or more and 3 stations for 40 years or longer. The maximum length was 52 years.
- b. The normal seasonal precipitation in the foothills, computed to June 30, 1933, was 22.75 inches. Normal monthly records shown below indicate the distribution.

Month:	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
	----	----	----	----	----	----	----	----	----	----	----	----
Precip. inches	.03	.04	.35	.93	2.19	3.57	4.75	4.05	3.74	1.90	1.00	.22

- c. Precipitation falls mostly in the form of rain except at the higher elevations where light snows occur.
- d. Precipitation increases about 7 inches for every 500-foot rise in elevation and about the same amount for each 35 miles increase northward in latitude.
- e. The foothills have become progressively drier during the last ten years. Normal precipitation in 1923 was 24.49 inches; in 1933 it was 22.75 inches.
- f. The climate of Sonora, a station with records extending back 40 years has become progressively drier since 1889.

7. Analysis of forage data for 1933.

a. Composition and distribution of species. Plot records were taken on approximately 26 species of grasses, 120 species of herbs, and 18 species of shrubs and trees. It was necessary to group species (and even genera) for compilation purposes because it was impossible to follow all species through the entire season.

Herbaceous plants comprise the bulk of the foothill forage. Browse species are of greater importance in the upper half of the foothills (1,500-2,500 ft.) than at lower elevations.

Considered in terms of grazing units, the herbaceous vegetation is fairly uniform and consists chiefly of annuals. Three genera of grasses and five of herbs dominate the landscape; however, seven genera of grasses and twenty of herbs are important as range plants. Herbs are consistently more abundant than grasses, comprising on the average about 80 percent of the vegetation.

About seven species of shrubs and trees are important as browse plants.

b. Duration of green forage. For purposes of analysis the "grazing season" (period of grazable green feed) was arbitrarily defined to extend from the time when forage was two inches high until it was "50% dry" at the beginning of the dry season.

The average length of this "grazing season" on all plots was 34 days. At 500-foot elevations the season started near the end of March and ended in late April. The average delay in both the beginning and end of the "grazing season" for each 500 foot rise in elevation was 6 to 7 days.

There was a lag of 7 days in the start of the season and of 15 days at its close, for every 50 miles difference in latitude northward. As a result, the northern end of the foothills had a slightly longer grazing period.

Over the foothills as a whole forage began to dry about April 10 and was virtually dry by June 10.

c. Height growth. Partial analysis of present foothill data indicates that height growth is independent of attitudinal and latitudinal influences.

d. Density. The average seasonal density of all plots was .37. The following table reflects changes during the season:

Date:	Feb. 3	Feb. 22	Mar. 21	Apr! 15	May 1	June 8
	-----	-----	-----	-----	-----	-----
Density:	.33	.29	.39	.45	.38	.38

The density on February 3 consisted chiefly of expanded cotyledons of herbs and primary leaves of grasses.

The maximum density (.45) was recorded at the height of the growing season when most of the plants were flowering.

Density tends to decrease above an elevation of 1,5000 feet. Variations by latitude are small and probably fall within the experimental error of estimate.

e. Volume. The 1,500-foot elevational zone produced the greatest volume of forage during the period of grazable green feed. Ratios of volume production for that period in five elevational zones follow:

Elev. ft.:	500	1,000	1,500	2,000	2,500
	---	-----	-----	-----	-----
Ratio:	1.5	1.8	2.5	1.5	1.0

The data showed no definite relation between volume and latitude.

8. Foothill work-center possibilities. Extensive field examinations have failed to disclose a satisfactory area for a center of work on either public domain, state, or national forest land. The purchase of private land appears to be the only remaining alternative. Negotiations are in progress to determine the possibility of land acquisition for this experimental purpose.

Major activities on pine ranges.

In the east-side pine region work consisted chiefly in selecting a work center at Hall's Flat on the Lassen National Forest; in initiating a preliminary survey of livestock damage to tree reproduction on the Blacks Mountain Experimental Forest near Hall's Flat; and in locating ten 1/2 acre livestock exclosures for the pine project on the Lassen and Modoc forests for late-fall fencing by ECW men.

Erosion - Streamflow

Berkeley Installations.

Of particular interest to investigators will be the methods employed

in sinking two soil core cutters into fifty inches of soil and the sealing off of the soil by means of a steel plate thrust under the core cutter and electrically welded to the walls of the lysimeter and to the bottom plate.

The soil core cutters were designed and installed for the purpose of (a) determining what difference in percolation characteristics disturbance of soil in the master lysimeters might have caused, and (b) to ascertain how long it requires disturbed soils to show characteristics in percolation similar to undisturbed soil. For experimentation in the isolation of the factors of surface condition of vegetation it was necessary to remove the soil by shallow layers, mix and return it by shallow layers of equal depth, so that soil conditions in each compartment of the lysimeters would be as nearly alike as could be made. Thus, for experimental purposes, it is not desirable to employ undisturbed soils in large quantities when the isolation and measurement of factors are the objectives of the study.

The San Dimas Watershed.

The San Dimas Watershed study has been the major enterprise under erosion and streamflow during the interval covered by this report.

Measurement of precipitation over experimental watersheds has occupied careful study. Provisions for locating rain gages on contours have been made. A total of about 20 miles of contour trails have thus far been completed and there are yet to be constructed 30 miles. By means of contour trails it will be possible to locate gages at any desired point on slopes in canyon bottoms as well as on ridges and on the several facets of exposure.

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FIRE RESEARCH

Detection Planning

The Fire Section has sustained an important personnel change since last report. Mr. Gowen was released by the Station, at the request of the Region, to assume the supervisorship of the Lassen Forest. Curry and Brown have been advanced in seniority, the former becoming project leader, and the junior staff position has been filled by the transfer from the Region of Junior Forester C. C. Buck.

Much time and effort this summer has been devoted to the extension to the whole Region of the fire detection planning technique as developed by the Experiment Station. In view of the demonstrated need of a complete recheck of existing provisions for fire detection, and the pending program of new construction under D.C.V., this work has been of great urgency. The Regional Office early in the season withheld authorizations for all new detection improvements until the new detection plan for each forest was complete. This has put to the test the value of the rating scheme and the practical application of the method, as developed by the Station.

Three training sessions were held in April and May. Nine forest officers and representatives of the State and Park Service attended eight day sessions. Nineteen recruits were given two weeks of training and supervised mapping. The training was concentrated on methods and technique of seen-area mapping by the field sketching method. In the instruction given Forest Officers, more attention was given to the detection planning job as a whole.

Three crews were organized and assigned first to supervised work on the Shasta Forest, then allotted to other Forests as scheduled. The time and effort required has justified itself and the field program has gone forward smoothly with uniform work and a high standard of accuracy.

With the field work provided for, the assembling of the data and compilation of results upon which to base administrative selection of lookout sites was the next hurdle. A force of six men was gradually built up and it was necessary to divorce Brown entirely from the research projects to carry on this phase. The drafting and compilation work necessary for each Forest is a considerable task. In many cases very poor maps had to be used, and new difficulties in coordinating the final results have kept appearing. But the time required to set up a completed lookout scheme with all the supporting data has been gradually reduced. In each case we start with a clean slate and ignore the present set-up for purposes of analysis. A conference has been called on each Forest plan as completed, in order to make the necessary decisions and approvals. Conferences have been held on seven forests to date. Four more will be ready shortly. Work is going forward also on Yosemite Park, Los Angeles County, and State protection areas. The project has increased in scope as it has proceeded until it is now in the nature of a State-wide plan.

Visibility Studies

Curry and C. C. Buck, the new member of the fire research group, have spent the summer on the Shasta fire experimental area on studies of the range of vision of lookouts, mainly, with some coordinated studies of rate of spread. Buck was formerly District Ranger on the Shasta and his familiarity with conditions has made his work of particular value.

The study has consisted of two main phases, the first an extension and continuation of the former radius of vision work by the use of natural targets, and the second a study of the visibility of test fires.

In the radius of vision study all natural-target series were revised in accordance with the theory of trend developed by Brown in the 1932 analysis. New target series were established on several lookouts. On some of these target series attempts were made to select targets of equal visibility at all distances so that the disappearance of the targets with the increase of smoke would indicate the radius of vision directly. A new Bennett-Casolla visibility meter was purchased and a continuous daily record maintained from one lookout.

The second phase of the study consisted of undertaking a series of test fires in a variety of directions and distances and under different atmospheric conditions to determine the time, distance, and size of fire relationships in fire detection. This undertaking received the larger part of the time and attention of the field force. Altogether, 169 fires have been set and studied during the season to date. From these fires we have a total of about 400 records of discovery at distances up to 30 miles. In addition we have a mass of charts showing rate of spread, to be correlated with the weather records maintained on the fire.

Four regular employees of the Station, with eight men for a suppression force formed the test fire crew. The fires were small, all less than 1/4 acre.

Equipment

The brush cutting power saw has been brought to a stage of development such that it is being manufactured on a small scale. Five units will be available for use on the "Great Ponderosa Way" firebreak which will be built by C.C.C. forces this winter over 800 miles of the Sierra front at the lower edge of the pine forest.

This year a stop watch was installed in a lookout for locating lightning strikes, timing the interval between strike and the sound vibration. A scarcity of storms has not permitted many records to be obtained but of late the distance of a few strikes has been located surprisingly closely by this method.

Some time has been given to the development of an instrument to detect hot spots along an apparently dead line. The instrument is still in an experimental stage.

Radio was used with uniform success as a medium of communication on the test fires. The research group is enthusiastic over the practicality of the S. P. sets developed in R-6.

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FOREST PRODUCTS

The Products Section has suffered a sever loss in the transfer of its Junior member, I. J. Mason, at the request of Region 6, back to that Region from which he came to the Station in 1929. Even more serious than the loss of a man was the fact, not contemplated in the initial acquiescence of the Station in his transfer, that the final stack-up was found to involve the necessity of his taking his position with him.

Logging and Milling Studies

Mason's transfer, coupled with the loss to the Station of his position has prevented the carrying out of plans to conduct new logging studies in the east-slope pine region. Our only other hope, that of securing temporary details of forest timber-sale personnel for study-crew duty, as we have in the past, was frustrated by the W.C.V. program. Even Brundage's completion of his much delayed publication on the technical application of logging and milling study data to lumbering operation lay-outs has been submerged by the demands of emergency programs, in the extensive examination of the management and logging transportation lay-out of the Station's two newly acquired experimental forests by Brundage. In conjunction with Dunning of the Forest Management Section, and the location of enough mainline truck roads thereon to keep available C.C.C. crews busy for the season.

Nothing approaching a final lay-out of spurs and logging units can be accomplished until detailed topographic maps and cruise data are available. A survey crew under Dunning's direction is now making a 100-per cent cruise and a 10 foot interval contour map of the Black's Mountain forest situated in the east-slope pine region. The ground is level to moderately sloping with no serious obstacles standing in the way of almost any kind of compartment subdividing which may be desirable from the viewpoint of differences in stand conditions or variations in silvicultural treatment. Trial of a wide variety of logging methods will be possible. An excellent opportunity is also offered in the Black's Mountain forest for experimenting with logging machinery, incorporating features designed specifically to reduce damage to reproduction and reserved trees. So far the whole idea behind commercial logging equipment changes has been reduction of logging costs. That damage to the residual stand has been lessened also in many instances is purely a chance accompaniment. Perhaps the F.R.A. national emphasis on forestry will make it easier to enlist the cooperation of logging machinery manufacturers in the construction and testing of "log-getters" which can be advertized also as real aids to forestry practice. This is especially urgent in regions where, as here, the saving of advance growth is the key to profitable sustained yield.

The Thompson Creek experimental forest in the west-slope region allows little choice in the location of main transportation arteries because of its rugged topography. The present stand is largely mature and over-mature with a ground cover of abundant brush but very little reproduction.

Though many of the slopes run from 40 to 60 percent it is probable that most of the entire area can be logged most economically with tractors. Trailers of the "Carco Yarder" type can be employed for direct-cross-country skidding over a small percentage of the tract and for landing in all of the secondary draws. For the steepest slopes some new methods of auxiliary line yarding appear feasible which should be superior to direct draw-bar skidding from both cost and damage standpoints. Before the schemes can be tested, however, certain new equipment will be necessary, again calling for material cooperation by makers of logging machinery.

Lumber Census

The lumber census of California and Nevada for the calendar year 1932 was closed June 30, 1933 with the issuance of a mimeographed preliminary statement in the form of a Research Note. The cut since 1929 has hurtled down the tobaggan as follows:

Year	M.B.M.	Percent of 1929
1929	2,063,229	100.0
1930	1,514,263	73.4
1931	957,740	46.4
1932	688,753	33.4

Out of 325 replies to the 1932 census questionnaire, 115 reported as "Idle" and 25 as "Dismantled" or "Out of business". Six non-operating concerns were in the group of 18 large mills having annual capacities of 40,000 to 175,000 M.B.M. per annum. The 12 active members of this group had reduced their collective output to 38 percent of their boom-period production. For the 18 largest mills as a whole, the 1932 cut was a bit less than 28 percent of pre-1930 production.

In the size-class producing from 10,000 M to 39,000 M a year each between 1923 and 1930, 15 out of 26 mills were idle. The 1932 output of the active mills in this class was only 19 percent of the past combined production of the whole group.

A summary of all mills reporting is given below:

Normal production:				Status in 1932.			
class, M.B.M.	:	:	:	Total	:	Percent of:	Aver. cut per
per annum	:	Active	Idle	Total:	:	total cut	active mill
	:	Number of mills		M.B.M.	:		M.B.M.
40 MM and over	:	12	6	18 : 433,927	:	62.9	36,161
10 MM to 39 MM	:	11	15	26 : 121,401	:	17.6	11,036
Under 10 MM	:	161(1)	119	281 : 134,200 (1)	:	19.5	828 (2)
All sizes	:	185 (1)	140	325 : 685,528 (1)	:	100.0	3,727 (2)

(1) Includes 38 Mills cutting less than 50 M.B.M. each. Combined output of the 38 was 775 M.B.M., not included in Census Bureau total.

(2) Deducting the 38 mills cutting less than 50 M.B.M. each for the year, the average output of the remaining 123 mills under 10 MM was 1,085 M.B.M.

Total active mills with these small ones omitted becomes 185-38, or 147, with an average cut of 4,685 M.B.M.

Forest Survey - Type Map

During the early summer six quadrangle units of the California Vegetative Type map were prepared and submitted to Washington for publication. Although it appeared doubtful at first that more than two of them would be published the latest word is that the U.S.G.S. is proceeding with the engraving of all six, thus making a total of ten published maps in editions of 1,000 copies each, when they are off the press.

Since the addition of Dr. Yates to the Type Map personnel in 1932 it has been possible to give proper emphasis to the botanical side of the project. The accumulated collections of several years have been organized and checked against the maps and sample plots and current collections of the field mappers are being properly taken care of as they come in. Yates is now getting ready a collection of specimens to be shipped very shortly to Washington.

The Type Map Herbarium promises to be one of the most comprehensive and valuable collections of California shrubs in existence. The field mappers have collected off the beaten paths of California botanists and as a result there will be a considerable contribution to the known range of many shrubs. The large number of specimens of a single species collected over a wide range promises to shed light on the evolution of the several species of such genera as *Arctostaphylos*, *Ceanothus*, etc.

Wieslander in addition to his duties in connection with the Vegetative Type Map has been spending a large part of his time since July 20 working with C. E. Dunston of the Regional Office on a reconnaissance location of an 800-mile firebreak extending the length of the Sierras along the lower edge of the ponderosa pine belt. This firebreak is for winter construction by E.C.W. camps and is designed to protect the Sierra timber area from brush and grass fires originating in the grazing lands below. The completed type maps and the knowledge gained by Wieslander of the foothill region in connection with the type map project have been very helpful in this firebreak survey.

Forest Survey - Wood Requirements

Both the exasperating lengthening of the work necessary in final completion of the bulletin manuscript on the cooperative El Dorado Land Utilization project, and the unforeseen demands of E.C.W. and then N.R.A. problems which had willy-nilly to be given right of way by Hill, have continued the jinx besetting the wood requirements project at this Station. With the ground-work laid and a small beginning in the collection of data, we earnestly hope for the release of E.C.W. finances for direct research as the door to man-power sufficient to speed the wood requirements work to its programmed status.

El Dorado Land Utilization Project

The newness of land utilization research and its consequent lack of generally accepted crystallizations in respect to procedure and methodology have combined to delay final acceptance and publication of the bulletin on the cooperative El Dorado Project. Major questions with respect to the organization of the manuscript as first completed and submitted, raised by Director Tolley of the Giannini Foundation of the University (the cooperator with the Station in the project) concerned the agricultural treatment to a larger extent than the forestry portion, but required realignment of the whole organization of material. Immediately thereafter Tolley was called to the Agricultural Adjustment Act administration at Washington for some three months and designated Prof. Benedict of the Foundation to act for him in respect to this bulletin. This necessarily resulted, regardless of ability, in injecting a whole new point of view and in increasing heavily the difficulties of reconciling divergent conceptions. Wieslander being in the field almost continuously, Hill for the Station has worked months beyond the expected time limit, with the co-author, Prof. Weeks, in the reorganization of the whole attack. The net result has undoubtedly been a distinct improvement in the clarity and effectiveness of the manuscripts, both through the able criticisms and suggestions of the respective Directors, and through the growth and clarification of their own concepts under challenge.

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CENTRAL STATES FOREST EXPERIMENT STATION

Black Locust

The computations on the cubic foot volume table were completed. The table checks in aggregate against the basic data to 0.01 per cent, but the average deviation on 393 of the 396 trees on which it is based is + 9 per cent. The data have been set up for three of the other tables which will be made for this species: merchantable cubic volume, International board foot and Scribner board foot volumes.

A post volume table in preliminary form was prepared during July, showing the number of split posts, 7 feet long, in black locust trees of different heights and diameters. There was also shown the average number of posts cuts per tree.

Another table is in process of preparation showing the content of locust trees in 4-foot bolts. Much locust is utilized in this form. To secure an adequate basis for this table, Kellogg has been working on taper tables using the 396 stem measurements secured by climbing plantation trees. He finds fairly smooth tapers for short trees and the taller height classes. The intermediate groups (50 and 60 feet) contain the most erratic forms of all, indicating maximum influence of branches in the crown.

In answer to inquiries for methods of extracting black locust seed, Kuenzel and Kellogg collected pods and tried out a bean sheller, a separator with clover-huller attachment, and a 22-inch separator with concaves set for wheat threshing. The results of these emergency investigations are reported in two "Station Notes": No. 1 entitled "Collection of Black Locust Seed" by Kuenzel and No. 2 entitled "Extraction of Black Locust Seed" by Kellogg.

Three days were spent scouting for suitable sources of black locust, shortleaf and pitch pine seed. The black locust seed crop is spotty, being prolific in some places and totally absent in others. A moderate pine cone crop is on hand.

Farm Woodland Management

Livestock Management Phase

The carrying capacity study, which is being jointly carried on by the Station and the Department of Forestry and Animal Husbandry of the Purdue Agricultural Experiment Station, entered its third and final year on May 10. Due to the limited travel funds of the Station, most of the inspection was done by Mr. Denuyl of Purdue. The results so far from this season's grazing very closely follow the predictions of last fall. The utilization of forage in all three tracts is about 25 per cent more advanced than in either of the previous year's tests. The animals in the six-acre tract were removed in July after losing weight almost from the start. In the twelve-acre tract the animals maintained their original weights over a period of eight weeks, but started to lose about July 1 and were removed to prevent starvation on July 25. The animals in the eighteen-acre tract made moderate gains until August 15, but have been losing weight since that date and are now down to their original weight at the start of the tests. They will undoubtedly have to be removed before the contemplated closing of the experiment on October 31.

One interesting observation made in late September was that while utilization of blackberry and corylus was complete in the six and twelve-acre tracts, the abundance of those two unpalatable species was greater in the eighteen-acre tract than in either of the two preceding years. Following a hot, dry six weeks in late June and July, the remainder of the summer has been comparatively cool and wet, which may in part account for this.

Regeneration Phase

Diller concentrated his work on about ten selected plots to determine the controlling factors in the heavy mortality in seedlings on these plots during the summer months. Light intensity, soil moisture, and soil temperatures were recorded and are being correlated with mortality counts on these plots. Observations indicate that wilting of oak seedlings will occur when soil temperatures at six inches under the surfact reach 90°F. and also if moisture content falls below 1%.

Locust Borer Investigation

The work of the locust borer field crews was continued during June under Dr. Hall's direction, until the reduction of funds for field work and travel made it necessary to dismiss field assistants. Several trips were made in Ohio and Michigan to advise owners regarding control measures for forest insect infestations.

One field trip was made to Illinois during early July. During this trip three areas were visited where experiments for the control of the locust borer had been started early in the spring. The badly injured stands, which had been clear cut in April, showed very good sprouting capacity, the resultant sprouts in many cases had grown over 9 feet in height.

The plantations of locust root cuttings, established in Illinois "blow sand" were in poor condition. The cuttings had sprouted fairly well, but the sprouts had suffered severely from sun burning and as a result only a very few still remained. Experiments with the propagation of black locust by root cuttings have been continued near Butler and Columbus, Ohio.

The work of the two lined borer (*Agrilus bilineatus* var. *carpini* Knull) was observed in Indiana and Ohio in beech stands which were over-mature or had been injured by heavy pasturage. This insect has been observed in Columbus on ornamental and shade trees. It appears that this insect may prove to be an important forest insect in the Central States if it continues to increase.

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NORTHEASTERN FOREST EXPERIMENT STATION

General

Altho the summer's work was much restricted by lack of funds for field assistance, considerable progress is being made in the development of the two experimental forests in the White Mountains thru the activities of Conservation Camps on or near these forests. The experiment station has had the benefit of a major portion of the crew from the Gale River camp right thru the season, and altho the Saco camp has done little on experiment station projects thus far, our needs should be adequately taken care of during the fall and winter, when some of the other road work this camp has been doing is taken over by N.R.A. crews.

The meeting of the American Forestry Association in the White Mountains of New Hampshire in September, afforded an excellent opportunity for the experiment station to show some of its work. The meeting visited both the Bartlett and Gale River Experimental Forests. The attendance on these field trips was about 200.

A pictorial album visualizing the work and problems of the Northeastern Station was prepared by Reinske during the summer, primarily for display in connection with the meeting of the American Forestry Association. The album is 14" x 17" in size. Each page shows a number of photographs with suitable explanation, illustrating a particular project. The pages as originally made up were copied photographically so that five copies of the album could be made up.

A new experimental forest has been made available to the Northeastern Station thru the cooperation of the New York State Conservation Department. A tract of about 635 acres, a large proportion of which is open sub-marginal farmland, has been set aside for our use near the town of Norwich, New York. This tract will serve primarily for experiments in reforestation, one series of plots having been established last spring.

Spruce Management

A plantation of 40,000 trees made by the C. C. C. on the old burn area on the Gale River Experimental Forest in the spring, met with abnormal losses due to the advanced stage of growth of the stock at time of planting and the unusually dry period which followed. Replacements have been made and an additional 20,000 trees are being set out this fall.

The eastern half of the area and an adjacent isolation strip were gone over by a Ribes eradication crew from the C.C.C. camp, and altho the Ribes were abundant a very satisfactory clean-up was obtained.

C.C.C. help was also used to release a 35-acre plantation of spruce set out in 1925 and 1926 from competition of aspen, birch, cherry, red maple, etc. The hardwoods were poisoned on part of the area and girdled or cut on the remainder. Poisoning was thought to have some possible advantage in elimination of future competition from sprouts.

Another interesting C.C.C. job in the Gale River Forest was the releasing of a natural understory of spruce and fir by removal of a hardwood canopy. The wood from this cutting will provide fuel for the camp during the coming winter.

The conservation corps men were used to do the selective cutting on a series of plots in pure spruce, running over 40 cords per acre in the Cherry Mountain area. These plots were laid out in 1930 but had not been cut because of lack of market for the timber. On one plot only a few of the largest pulpwood trees were cut. This yielded about 9 cords per acre of the finest quality pulpwood. On a second plot the thinning removed most of the suppressed and intermediate trees yielding about 15 cords of wood per acre of relatively small average size. A third plot was cut clear and additional areas were reserved for check.

Growth Management of Northern Hardwoods

On the Bartlett Forest a series of 17 plots have been established to study on areas clearcut for fuel the problem of weeding northern hardwoods, with respect to age at which weeding is most effective, amount of weeding necessary, and method of cutting the inferior growth.

These plots lie in a respectively large area cut-over during the past 15 years which will be treated this fall by the Conservation Corps.

The young, many-aged stand of white pine immediately behind the administrative site has been marked for selective pruning, thinning, and release operations by the Conservation Corps.

Plans are also underway for starting a large scale experiment to compare clearcutting with light selection in the handling of the many-aged stands of hardwood on the Bartlett Forest, which are typical of large areas in the region.

The new volume tables for northern hardwoods, showing merchantable contents in cubic feet and in board feet, International 1/4" rule, were completed and given a limited distribution in mimeographed form.

Fire Damage

During July and August, Stickel, assisted by Morey, initiated work in the study of basal wounding of trees by fire. This is the third phase of the program of fire studies undertaken by the station. Briefly the new project consists in correlating initial basal bark discoloration with Cambial wounding and subsequent recovery, decadence, or death. The field technique is based largely upon similar studies made at the Appalachian Forest Experiment Station, with the exception that only on a small number of the injured trees is the discolored bark removed at the first inspection to observe cambial wounding. By spreading the bark removal of trees, whose bark discoloration zones are known, over a number of years a better knowledge of the relation of insects and fungi to fire damaged trees will be obtained. All told, complete bark discoloration diagrams were obtained in 308 trees, and both bark and cambial diagrams on 25 additional trees. The unpeeled trees are distributed over 6 permanent study areas, 3 areas with 57 trees being in the spruce-northern hardwood region of New York and 3 areas with 251 trees in the oak region of the same state.

Some tentative conclusions obtained from the limited bark-cambial wound diagrams are that, as Nelson, Sims, and Abell found, the extent of interior wounding generally follows more closely the entire area of bark discoloration than the individual zones of char or burn. This appears to hold true with white oak, red, and sugar maples, and to a lesser degree with yellow birch. In the case of young paper and yellow birches, young northern white pine, young red spruce, and young balsam fir, cambial wounding extends far beyond the visible zone of scorch. There seems to be a direct correlation between bark character and injury. Smooth barked trees seem particularly susceptible to severe cambial injury and often death even if the bark is only scorched in the slightest degree. Other trees of equal age but with fissured bark seem more heat resistant. Whether this is due to inherent characteristics or differences in heat intensities resulting from variations in the angle of incidence with which the heat rays strike smooth and rough-barked trees cannot be said. Gross bark thickness does not appear to be the criterion of fire resistance. This is well illustrated in the case of chestnut oak which appears to be the least resistant of the oaks.

The bark of this species, altho characteristically thick, is broken up by very deep fissures. Bark of this character offers far less resistance to the heat than does the thinner but less deeply fissured bark of such species as white and scarlet oak.

The relationship between fire damaged trees and insects is very striking. In the case of northern white pine bark-beetles and wood-borers were found working in fire damaged trees within three months after the fire. In the case of hardwoods, to which less attention seems to have been given in this connection, ambrosia beetles seem to take the place of true bark-beetles found so commonly in fire damaged conifers. Practically no fungi have made their appearance as yet on the injured trees, the majority of which occur on areas that were burned over less than six months ago.

It is planned to burn over next spring an area of about 12 acres on the Bartlett Experimental Forest, to provide additional material for study of basal wounding and other phases of fire damage. A suitable area has been selected, and it is hoped that the necessary fire lines can be constructed by the C.C.C. An N.R.A. crew started work on October 9, laying out the area and tallying the reproduction. Miller of the Biological Survey, will assist in this job, not only to study the changes in wild life populations but more especially to study the change in food plants following fire as compared to similar areas clearcut for fuelwood.

Planting

Doctor Stewart spent most of the summer months preparing a report on the survey of forest plantations thruout the region which he had conducted during the previous two seasons. About half of the plantations studied were of pure white pine, one sixth were red pine, and only a small percentage mixtures. Success of planting on the better sites has been distinctly better than on poorer sites. Spruce plantings appear to be more successful within the natural range of the genus than in Southern New England and New York.

The fertility levels of old fields can be judged by the character of the herbaceous vegetation and it appears that most abandoned farms have a fertility which may support conifers better than hardwoods. No immediate soil deterioration was observed as a result of pure plantings, altho the beginnings of podsol formation were found in a few plantations about 40 years of age.

Forest Pathology

The N.R.A. program has made possible the assignment of two men to work under Doctor Spaulding's direction on the Nectria and Strumella cankers which present problems of particular significance in connection with weeding, thinning, and other cultural operations. It is believed that in a six months period enough can be done to be of immediate value to the C.C.C. and that the work started which will improve the establishment of permanent study plots, may be subsequently followed up by the regular staff.

Resinosis Disease in White and Red Pine Plantations

The summer meeting of the New York Section, Society of American Foresters, included a visit to the plantations on the water-sheds of the City of Rochester, where a new disease is causing complete loss over limited areas in thrifty white pine and red pine plantations from 15 to 30 years of age. This disease is being studied by Doctor H.H. York of the University of Pennsylvania, in cooperation with the New York Conservation Dept. The Bureau of Plant Industry has recently supplied a man to assist in a survey of the present distribution of this disease. It appears to be a root disease and causes lesions and pitchy exudations around the root collars of the infected trees. For this reason it has been called "resinosis disease." The causal organism has recently been isolated but not yet identified. After the presence of the disease becomes evident, death takes place very quickly. Trees maintain vigorous growth right up to the year of death.

Forest Entomology

Because of restricted funds for field work, Doctor MacAloney's work has been largely limited to routine examination of permanent sample plots in his white pine weevil studies. Doctor MacAloney has, however, devoted considerable time to assisting and advising the C.C.C. in insect control projects and in operations to salvage badly weeviled white pine plantations in southern New England.

A conference on the European pine shoot moth situation, called by the Eastern Plant Board, was held in New Haven. This conference appointed a committee to formulate recommendations for whatever quarantine measures might seem feasible to aid in controlling the situation.

Forest Biology

Miller's work on the relation of birds to white pine weevil is nearing completion. Altho the results are largely negative as far as control is concerned, considerable new information was brought out by the study. Among other things he found the actual number of weevils maturing from each infested leader to be much greater than previously reported. He also found a much larger variety of secondary insect associated with the weevils than had previously been reported.

Miller has been negotiating with the State of New Hampshire for cooperative use of one of the state forests for experiments in game management in relation to forestry.

NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Forest Survey

Progress on the Forest Survey has been very disappointing during this season, particularly since June 1. A good start was made on field work in April and by June 7 the crew had built up to six men, and plans were laid for mapping at least 1 1/2 million acres during the summer.

Shortly before July 1 the uncertainty of funds for the work began to cut down the crew. The Station held on as long as was possible but in fairness to the men employed it was necessary to shift them to more certain employment outside the Experiment Station, as opportunities arose. Fortunately it was possible to place all of the temporary men, and the Survey crew dwindled one by one until all field work had ceased by the end of July. The total field accomplishment for the season thus far is the mapping of 350,000 acres. Of this, six townships were done in cooperation with the office of Forest Management, which furnished two men for a month.

The total field accomplishment in this region is about 855,000 acres mapped. This area includes some of the most severely cut and burned lands of northern Idaho. It covers a large portion of the general area in which lands are being offered to the Government for exchange or as donations by several of the large land holders of the region and the counties concerned. This section of Idaho, lying in Latah, Clearwater, Benewah, Shoshone, and Kootenai Counties, contains some of the best white pine land in the region. It is the center of concentrated fires eradication, insect control, land acquisition, and planting work. The information made available by the survey is finding a ready market among all of the agencies concerned. Type maps are in demand even before they are inked, and the only complaints concerning the work are that we are not covering the country fast enough.

N.I.R.A. funds which have recently been made available will relieve the situation somewhat. Present plans call for placing 4 or 5 mappers in the field by October 1. Work will continue as late as weather permits. The time for effective work in the white pine type has nearly passed. Therefore, work this fall will be largely confined to the ponderosa pine type.

Late in July Glacier National Park was given permission to put on a 10-man timber type mapping crew using E.C.W. funds. Professor Fay Clark of the University of Montana Forest School was placed in charge of the work. Four of the Station's field assistants, released because of lack of funds, were given employment by the Park Service on this crew. One of the Survey's field mappers was placed in direct charge of the type mapping. The timber type mapping work being done by the Park Service closely follows the plan set up for the Inland Empire Forest Survey project.

The estimate of merchantable timber in the Park will be less intensive than that made on commercial stands in this region. The Park project is planned as a two year job. Bradner spent two days early in August with the crew in the field inspecting the work.

During the latter part of the summer Bradner collected detailed "40" estimates on 70,000 acres of merchantable timber in Bonner County, Idaho, and on 93,000 acres in Pend Oreille County, Washington. The estimates for Pend Oreille County cover about 95 per cent of all the merchantable timber in the county except State and Federal. Ninety per cent of the merchantable timber in the two above counties is in the hands of some six large owners. Information on ownership, lands cut-over, burned, agricultural, and grazing were also obtained for the two counties.

Requirements

From June 6 to 14 building permit records and other data pertaining to lumber and timber products requirements of the Butte mining district were collected by Whitney at Butte, Montana. The principal agencies contributing information were the City Building Inspector, City Engineer, City Clerk, various departments of the Anaconda Copper Mining Company, the Montana Power Company, the Mountain States Telephone and Telegraph Company, and the County Surveyor's office. Several contractors and real estate dealers were interviewed. Detailed bills of material were obtained for two commercial buildings recently erected.

Some of the requirements data obtained in Butte, especially that from the Montana Power Company, and the Anaconda Copper Mining Company, will have State-wide application. Records furnished by the Montana Power Company show for several years their total annual requirements for poles, stubs, and cross arms in Montana, also total mileage of distribution and transmission lines. Average requirements per mile of line can therefore be computed. The output of the Anaconda Copper Mining Company's Butte mines virtually constitutes the Montana production of copper. Including the companies which have been consolidated with it. Anaconda has occupied the position of the world's largest producer of copper and silver for about 45 years, with also a large output of zinc, lead, gold, arsenic, and other metals. The records obtained from this company will make it possible to convert their timber products consumption to timber products per unit mine output.

From July 27 to August 24 additional progress on the survey of urban construction included about 15 days field work at Spokane, Washington and 4 days at Lewiston, Idaho. The form of building permit application used in Spokane shows number of stories, but does not include size of building or floor area, and for this reason card records were not taken in detail for any year. Summarized information as to class of buildings, total volume and cost for each type of construction was checked at the building inspector's office. It is believed that a close estimate of the lumber requirements for the city in 1929 can be made from supplemental data furnished by architects and contractors.

Bills of material obtained at Spokane included seven one-family dwellings, two school buildings, three commercial buildings, and two hospitals.

At Lewiston, Idaho, building records for the past seven years were found to be in very good shape. Card records for 1929 were taken. Summaries showing number of buildings by classes (dwelling, garage, store, etc.) and costs for all years from 1926 to 1932 were obtained.

Wood Preservation

During the period July 27 to August 24 in Spokane, Whitney spent about 6 days on C.C.C. work as inspector of lumber and piling purchased from the Washington Wood Preserving Company for treated timber bridge construction. The inspection covered six car loads of Coast fir material treated in transit and reshipped to St. Regis, Big Timber, Libby, and Whitefish, Montana. The purpose of this inspection, requested by Central Purchase, was to check quality and treatments, rejecting all materials not complying with the specifications of the bid contracts.

All timber was given a straight creosote treatment by the Boulton-Rueping process using Grade One domestic creosote oil. Penetrations and absorptions of the preservative were checked for each charge. The average net absorption for 10,166 cubic feet of lumber treated was 9.63 pounds per cubic foot. The piling received 8.78 pounds per cubic foot. Copies of a report covering these treated timbers were furnished the offices of Engineering and Central Purchase, and the Washington Wood Preserving Company.

Logging and Milling

Office compilation of the field data for the Anaconda Copper Mining Selective Logging study is about 75 per cent complete. Anderson spent about three weeks at the Laboratory last summer assisting in the carding and summarizing of the data. Present progress now being made on this study indicates that the manuscript of the final project report will be ready by January if not before. The analysis of tree values by silvicultural tree classes has just been completed. The Dunning system of tree classes was used. The results indicate that these silvicultural classifications could not be used as a basis for segregation of tree values. The maximum spread in lumber selling value between the average values for all seven tree classes was only \$2.63. Lumber yielded by class 4 trees had the highest value of \$22.10 per M, while class 2 trees were lowest in value at \$19.47 per M.

Data for all ponderosa pine selective logging studies made by the Section of Products since 1928 are now being carded and summarized by the computing section at the Laboratory. These data will form the basis for a bulletin on selective logging in the ponderosa pine type of the Inland Empire.

Measuring Fire Danger

The outstanding practical product of the past season has been the quite satisfactory functioning of more than forty inflammability stations on the thirteen fire-forests in Region One. Based on daily measurements at these stations the Supervisors reported each day to the Regional Office the class of fire danger as determined by the Fire Danger Meter. While these reports are believed to have indicated somewhat greater danger than actually existed, they can be corrected before a rating is made of the character of the season for the Region.

This season has been most peculiar in several respects. Beneficial conditions such as normal rainfall and less than the usual frequency of lightning have been accompanied by extremely high temperatures and record breaking low humidities at some stations. Missoula is one example of this with normal rainfall, little lightning, yet with five consecutive ten-day periods each having the average 5 p.m. relative humidity under 25%. For July 21 to 31 this average was 13.2%, which is lower than the worst experienced in 1931. A careful analysis of the records for all stations must be made before a dependable statement of the character of the 1933 fire season can be issued.

The outstanding technical event of the summer was the manufacture, installation, and testing of "Mrs. Robot". This new device was designed by M. E. Dunlap at the Madison Laboratory to produce an automatic and continuous record of duff moisture, wood moisture, and wind velocity. Operated in conjunction with a hygrothermograph this new instrument will permit a study of differences in inflammability on north vs. south slopes, at low to high elevations, and under various densities of canopy that could not have been done by any other means. The tests throughout July, August, and September have proved that the principles of construction are sound. Only a few minor improvements have been indicated as desirable. A report on this instrument has been issued by the Madison Laboratory under the title "The Development of the Fuel Hygograph."

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PACIFIC NORTHWEST FOREST EXPERIMENT STATION

General

It will be impossible in this short report to chronicle all the eventful happenings at this Station during the last four months. It is therefore necessary to pass over such matters as the procession of interesting visitors that have been with us, the days spent on financial worries, and the difficulties in trying to get something done on ECW and NIRA projects.

Moving

The outstanding event of our physical life was moving from the Lewis Building to the New U. S. Court House the end of June. We are now thoroughly established in our 27 rooms, which are admirably arranged for our purposes and are proving very satisfactory. We have received many congratulations on our quarters and their arrangement. We still lack blinds on the windows and shelving in the library and storage rooms. The temperature and moisture control kiln was successfully moved and re-set up in our spacious laboratory room, and two runs of fuel samples have already been made.

Exhibits

An attractive feature of our suite is the considerable number of interesting, educational pictures which have been hung on the walls and several displays in regular exhibit cases, illustrating such things as the process of briquetting sawdust, woods used in the new building, metal connectors, compression failure in spruce, wooden money, publications of the Station, the Tillamook Fire in comparison with normal fire losses, the Wind River Arboretum, etc.

Big Fire

The great Tillamook County Fire was a nationwide forest tragedy and has occupied a good deal of the time of the men in this office. Under the Section of Silviculture below it is described in further detail. Munger has been appointed chairman of a subcommittee of the forestry committee of the Portland Chamber of Commerce to consider what that agency may do to facilitate salvage. Through this connection and otherwise, the Station has been consulted by many in regard to the damage done and the technical features of salvage.

Governor's Fire Committee

Governor Meier of Oregon has appointed a committee of three to recommend what needs to be done to prevent the recurrence of such devastating fires as have visited our forests, culminating in the recent great Tillamook Fire. The committee consists of the State Forester, Regional Forester, and the Director of the Experiment Station.

Cruising of Experimental Forests

Practically the only work upon which the Station has used directly the CCC personnel in an extensive way was on the cruising of the Wind River and the Pringle Falls Experimental Forests. The original three experienced cruiser-foremen have now been increased to six, but in spite of that the work has dragged and field work on both areas is still far from complete. It is felt that an excellent job is being done and that unless early snows prevent, field work will be concluded this fall.

On the Wind River Experimental Forest considerable progress has been made on the road system under the ECW program, this work being handled by the Columbia Forest.

Section of Silviculture

Fire Studies

Outstanding in fire research this summer was the opportunity to study the largest fire Oregon has experienced in many years. The Tillamook Fire started August 14 in slash of a going logging operation. More than 200,000 acres, of valuable Douglas fir old-growth timber, over half of it virgin forest, were crown-burned in a day and a half. The latest estimates show the total net burned area to be 261,640 acres. Crown fires were prevalent, even at night, and although more than a thousand men were employed on the fire only one human life was lost. Practically all of the area burned is privately owned; it was the largest high quality block of privately owned timber in western Oregon. At least 10 billion board feet of timber was killed; this is more than twice the volume of timber killed by all fires on private land in Oregon (both pine and fir regions) in the past 20 years. McArdle, Matthews and Morris are preparing a comprehensive report covering the spread of this fire as influenced by weather, fuel and topographic factors. Preliminary analyses were made for various uses while the fire still was in progress.

Twenty-two stations were established throughout the region this summer for measurement of fuel inflammability. In addition, considerable supplementary work was done at the Wind River Station. At the latter place, more than 200 hazard indicator sticks of various sizes, shapes and treatments were measured daily for moisture content.

O'Day reports substantial progress on the study of static as an indicator of lightning storm weather. He apparently has been able to localize his work to an area having about 25 miles radius from his instruments, and although he does not appear to be able to determine positively when a storm is coming he can state with accuracy when threatening conditions will not materialize into a lightning storm.

The visibility studies (which were to be completed this season) could not be finished because the Tillamook fire required the presence of all fire studies personnel. Two visibility meters were developed to the point where measurements can be taken at any time of day, in any direction, at any distance, with different qualities of eyesight, and still use natural targets. Which one of these two instruments will prove to be the most efficient design can not be decided without further actual experimentation. Substantial progress also has been made in analysis of past fire records to obtain information needed to round out these visibility studies.

Financial Aspects of Ponderosa Pine Silviculture

Rapraeger of the Section of Products with help from Kolbe and the Director has analyzed in great detail the financial aspects of various methods of cutting under sustained yield public management. This is a study which we have long wanted to make but hitherto have not had the necessary basic data. The report is practically ready for limited distribution. It will be followed by a companion report on the financial aspects of various methods of cutting ponderosa pine under private ownership. Completely authoritative pronouncements on the economics of various types of selection cutting can not be given until someone has made a logging engineering cost study for this type.

Douglas Fir Reproduction Studies

The mediumly heavy cone crop of 1932 and the favorable weather in the spring of 1933 has resulted in the best crop of Douglas fir seedlings to be found on the sample plots since 1926. Direct seeding in the fog belt with small-seeded species (western red cedar, western hemlock, red alder and Sitka spruce) for the fifth successive year shows satisfactory results on one and two-year-old burns. Very poor results were obtained on the same areas with Douglas fir seed.

Mensuration

During the months of June and July, a good start was made on the even-aged phase of the Sitka spruce-western hemlock growth and yield study. With three field assistants, Meyer was able to make rapid progress in the collection of plot material, taper analyses and strip surveys. The sampling of certain age classes was easy because of the existence of extensive areas of second-growth. Detailed search, however, was necessary to obtain certain grades of mixture. The site range in the territory covered by this type proved to be relatively narrow and before the project is completed recourse must be made to data gathered in other regions or by other agencies, such as the British Columbia Forest Branch, or Region 8. When the financial

stringency hit us the field party was summarily dismissed and field work stopped in the height of the ideal season. By that time measurements had been taken on almost 150 plots, representing such a good age and local site range, that a temporary yield table can be drawn up for northwestern Oregon conditions, if occasion demands. When field work is resumed, about a month and a half will be required to complete the sampling of Oregon and Washington coast conditions.

Forest Survey

During June all remaining type mapping in Kitsap and Josephine Counties and check cruising in Snohomish and King Counties was completed. This wound up all field work in the Douglas fir region, with the exception of four weeks' check cruising and two weeks' type mapping in Jackson County, which work will be started October 1. Early in July the east side field instructions, and more particularly the tentative type scheme, were revised again and Kimp started collecting cruise and other forest data for the central part of Oregon between the summit of the Cascades and the Deschutes River as far south as Bend. When these data were consolidated on progress maps, the holes in the field work were apparent, and one of the temporary Survey type mappers was made an ECW foreman and was assigned to do field work on these blank areas, with particular emphasis on covering as much high country as possible during the summer. The drastic cut in allotments in July necessitated the dropping of all temporary employees, which eliminated practically all field work and kept the regular Survey staff in the office on the job of compiling type and volume data for the Douglas fir region. This work inevitably went ahead slowly and was almost constantly interrupted by requests for compilation and presentation of type and volume data from both public and private agencies.

Early in July the new 1/4-inch-to-the-mile base maps of western Oregon and Washington were received from the U. S. Geological Survey and were distributed to public and private agencies and individuals in the region. They were very well received, and a large number of people expressed a desire to obtain the regional type maps when they are prepared. Early in the summer the new 1-inch-to-the-mile map of the Olympic Forest was finished, incorporating both base and survey type data on the negative so that any number of copies of this type map can now be made very easily. It is hoped that this procedure can be followed for all other national forests and later for all other lands outside the national forests in the region.

Plans and outlines were prepared for the writing of detailed reports by the men who are responsible for the type mapping for all counties in the Douglas fir region, and two such reports have been prepared. These reports are intended to supplement the detailed statistics of types and volumes for each county and are especially for the purpose of bringing out all those items and facts regarding forest conditions in the county which otherwise would not be evident in cold tables of statistics.

All check cruise data for every county in the region were analyzed and rechecked to get understory and hardwood correction factors and also to get the proportion of the different timber size classes in each type.

Considerable time was spent working out sample tables and graphs to illustrate methods of summarizing and presenting Survey data for county units.

By October 1 the Survey, under the NIRA program, has at work one stenographer, three assistant technicians, two junior computers, and two draftsmen, with more to come. All of these people were obtained through the local District Manager of the Civil Service and are exclusive of the request for technicians in the hands of the Washington Office.

During the latter part of September the entire Survey staff worked at generalizing all national forest type data and transcribing these data on the new 1/4-inch-to-the-mile base maps of the two states. This was done at the request of the Washington Office, which plans to use these maps at the conference called to discuss the conservation provisions (Article 10) of the code for the lumber industry.

During the past four months the Survey staff has spent many weeks of time compiling and tabulating data on types and volumes in answer to the increasing demand for such data from both public and private agencies. The War Department in its reports on river and harbor and flood control projects, the Washington State Canal Commission, local Chamber of Commerce, the Regional Office of the Forest Service, and other sections of the Station, have all requested Survey data. In spite of all the requests and other things diverting the attention of the reduced Survey personnel for the past four months, some progress was made in the routine job of compiling type and volume data. If enough extra help under NIRA can be obtained, the straight job of compiling type and volume data may be finished this winter.

Nothing has been done since spring on the fire depletion phase, and in all probability the Tillamook Fire has made the fire data gathered to date seem inconsequential. It may be that the only way to handle the depletion phase in this region will be to present what might be called "normal" losses for a certain period of years and also at the same time present some figures for catastrophes which can be arbitrarily spread over a period, the length of which may be arrived at by noting the years occurring between major catastrophes in the region.

New Public Domain

Field work in gathering data which will show the amount and location of tax delinquent, tax reverted and other public lands was completed early in the summer for the forest areas of eighteen counties west of the Cascade Summit in Oregon and Washington.

Numerical compilation of these data is well under way. Mapping these data on inch-to-mile county maps has been completed for four counties, namely, Columbia, Clatsop, Tillamook and Wahkiakum. The Jefferson County map is nearly complete. A special intent in ownership map was prepared for Wahkiakum County.

Selective Logging in Douglas Fir

Brandstrom returned from Washington, D. C. at the end of May. June and most of July were spent in revising the selective logging report which was forwarded to Washington for printing in the latter part of July. Since that time Brandstrom has devoted his time largely to collaborating on the Douglas fir management report with Kirkland, who arrived at the Station in June and stayed until the end of August. Mapping and cruising of two sections of timber near the Wind River Branch Station was undertaken in August, using methods designed for selective tractor operations.

Section of Products

Requests for Information

During the summer there have been more than the usual number of requests for products information. In brief these requests have been along the following lines: the comparative properties of fir and oak for beer barrel staves, the yield of heptane from Jeffrey pine, outlets for Douglas fir oleoresin, the extent of the pole industry in the region together with the possible supply and current prices, the weight of green and dry alder logs, the heat value of sawdust briquettes and of Douglas fir bark, a method for extending the Scribner rule to small diameters and short lengths, the supply of pulp woods in the region, shipping weights of lumber, specifications for Douglas fir piling, the lumber cut in detail for various counties.

Wood Preservation

A new departure in wood preservation in the way of a portable pressure treating layout built on a motor truck was visited.

The treatment is called the "mineralized cell" process. Material is treated with copper sulphate, zinc chloride, arsenic and an unknown chemical in water solution. The solution is applied under 10 pounds per square inch pressure and at a temperature of 110°-120°F., with an adaptation of the Boucherie equipment consisting of a cap over the butt end of the piece. The solution travels lengthwise of the sapwood, taking about 8 hours for a 40-foot Douglas fir pole. The treatment can be given in the field where accessible to a motor truck.

Douglas Fir Mill Production Studies

The computations on much of the data on the two mills studied last year have been verified, and the first draft of a combined report on the two studies has been completed.

Financial Aspects of Timberland Management in the Ponderosa Pine Region

A report on the public ownership phase will be completed shortly after the first of October.

Census of Lumber, Lath, and Shingle Production

The 1932 census was completed early in June. 1,759 approved schedules were forwarded to Washington. Three news releases were prepared and were used by newspapers and lumber trade journals.

At the request of Mr. H. A. Templeton, who represented the independent lumber wholesalers at the Washington, D. C. conference of the lumber industry to formulate a code under the Industry Recovery Act, information was compiled showing the cut of mills in the Douglas fir region by capacity classes. This compilation showed that in 1929, 802 operating mills produced nearly 9,961 million feet of lumber and in 1932, 441 operating mills produced 5,115 million feet.

Farm Timberlands

A rough draft of a working plan has been prepared. Extension foresters in various parts of the country have been contacted for their experiences in (1) various methods of approaching the marketing of farm timber products, and (2) in cooperatively marketing these products.

Small Sawmills

The second draft of an article dealing with the place of the small mill in the Douglas fir region is now ready for publication and has been accepted by the Timberman.

Minor Species

Some time was spent in bringing together in report form information concerning black cottonwood.

Forest Survey, Requirements

A few days were spent searching out sources of information on fruit and vegetable production and shipments with the idea of eventually computing a converting factor between these and the lumber required for containers.

Forest Survey, Cutting Depletion

In the November 1932 report, mention was made of the preliminary results of the cutting depletion study for western Oregon and Washington. The final tables have now been completed and the report is being prepared. These tables show the annual depletion by states, economic units, counties, items, and species during the period 1925 to 1929.

The annual depletion from the production of items cut from saw timber during this period in M bd. ft. log scale was as follows:

	: Logs	: Fuelwood	: Posts	: Pulpwood	: Veneer : Shingle : blocks : bolts
Wn. Oregon	3,069,113	187,810	2,758	30,940	—
Wn. Wash.	6,353,457	165,055	2,371	43,855	26,100
	9,422,570	352,865	5,129	74,795	26,100

Douglas fir constituted 73.3 percent of the sawtimber depletion, western hemlock 12.7 percent, western red cedar 7.6 percent, Sitka spruce 3.9 percent, with the remainder made up of ponderosa pine, white fir and the hardwoods.

The total material cut from timber less than sawtimber size amounted to 82,431,973 cubic feet, solid wood. This included items such as fuelwood, poles and piling, hewed ties, posts, mine timbers, pulpwood, and excelsior bolts.

Forest Insurance

Shepard left for California the end of August to make the forest insurance study of the sugar pine type. The great Tillamook County Fire, which killed very much more timber than has been killed in the Douglas fir region since the days of organized fire protection, was very upsetting to the hazard factors which Shepard had worked up. It necessitates an entirely new and very much higher loss ratio than heretofore indicated. Moreover, the psychology of this very disastrous fire upon possible insurers and insurors is very bad.

SOUTHERN FOREST EXPERIMENT STATION

Naval Stores

A tropical hurricane on September 4, 1933 caused severe damage to the turpentine forests in north Florida. Interesting comparisons may be made between the damage occurring on one of the Experiment Station's turpentine tracts which was exposed to the worst of the storm, and the loss upon adjacent commercially operated tracts. The Station's stand has been worked conservatively, whereas in the commercial stands the trees have been subjected to deep chipping and, generally, have been worked with two faces. The mortality caused by the storm in the Station's stand was slightly less than one percent while in the commercially operated stands the loss was more than four times as great.

Only seven trees were killed out of about 750 on the Station tract. One tree which had a small cat-face with rot extending into the roots was uprooted. Another round tree broke off 20 feet above the ground. The other five had all been weakened by rot and insects which gained access through incisions for tins made in the face or through wood exposed at the base of the tree for the purpose of attaching tins. No trees faced without exposing wood were lost, nor were any trees lost which had tins attached by nails. The conservative policy of avoiding deep cuts and unnecessary exposure of wood was thoroughly vindicated.

Management

At the Camp Pinchot Branch of the Station, in cooperation with the Choctawhatchee National Forest Administration and the C.C.C. forces, an experiment in cultural work was initiated. Tests were made of methods of releasing longleaf pine from oak competition by removing the oak with axes, machetes, brush hooks and by poisoning with sodium arsenite. Growth in the shade of the oak brush has so weakened the pine saplings that unless care is taken to untangle the pines from the oak branches when the oaks are felled many of the pines are bent over and permanently injured or killed. The work progressed at the rate of approximately six acres per man day. Fifty acres with an eight man crew and a boss was considered fair.

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At Urania, Louisiana, Bickford, assisted by C.C.C. workers, began some stand improvement work in the Greeley Pasture. All hardwoods of undesirable species or form that now are obviously interfering with the normal development of the more valuable pines are being removed. During a three weeks' period the workers averaged about two acres per man per day with an actual working day of 5 1/2 hours.

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The results of a recent study by the Southern Station of the relative advantages of the clear cutting and selection systems for pulpwood production in shortleaf and loblolly pine indicate that while immediate returns are higher from clear cutting to a 5-inch diameter limit, the returns over a 10 to 12 year period are much greater under the selection system of cutting.

The selection system specifications for uneven aged stands are as follows: Leave 1 seed tree 10 inches d.b.h. or larger on each 1/4-acre; cut all other trees over 9 inches d.b.h.; and a certain proportion of 6 to 9-inch trees, depending upon the condition of the stand. In irregular stands with a wide range of diameter classes and uneven crown canopy and poorly stocked with reproduction now on the ground, not less than 50 trees (6 to 9 inches d.b.h.) should be left per 1/4-acre, while in such stands well stocked with reproduction not less than 25 trees (6 to 9 inches, d.b.h.) should be left per 1/4-acre. In even-aged stands or stands of uniform diameter, in order to preserve the growing stock, the following rules are advocated:

1. Leave 1 seed tree 10 inches or more d.b.h. per 1/4-acre.
2. In stands averaging 11 inches d.b.h. or more, leave all trees below 9 inches d.b.h.
3. In stands averaging 8 inches d.b.h., leave at least 50 trees 6 to 10 inches d.b.h. per 1/4-acre, spaced not more than 15 feet apart.
4. In stands averaging 5 inches d.b.h., no cutting should be permitted.

Contrasting this selection system with a system of clear cutting to a 5-inch diameter limit in one stand of shortleaf and loblolly pine in north central Louisiana gave the following results:

The present volume of the stand is 19.2 cords of pulpwood per acre. Cutting under present practice (5-inch diameter limit) would remove 19.05 cords, which, at the rate of 50¢ per cord net, is worth \$9.52. The 0.15 cords left on the acre would increase in the next 10 years to but 0.95 cords worth 48¢. Under the selection system, 5.0 cords left would increase, in the same period, to 9.4 cords, of which 4.4 cords worth \$4.20 would be cut at each 10-year period. Discounting both these expected returns back to present values (at 4 percent compound interest) gives, for the clear cutting system, a present value for the cut 10 years hence of 32¢, and for the present value of the series of cuts coming each 10 years, \$4.58. The total present value of the stand under the clear cutting system is, therefore, \$9.52, plus 32¢, or \$9.84. The total present value of the stand under the selection system, however, is \$7.10, plus \$4.58, or \$11.68, equivalent to an interest return on the investment of 6.5 percent, or a return of \$1.74 more per acre than by clear cutting. Furthermore, under the selective system, stand improvement would be rapid so that values up to \$20 or more per acre would accrue, whereas no such improvement would be possible under the clear cutting system.

Financial Aspects of Private Forestry

A preliminary report on the first case study of the Financial Aspects of Private Forestry has been completed. The case selected is a small forest property in the shortleaf-loblolly pine and hardwood type with an area of 3,000 acres. The timber is mostly advanced second-growth with the best stands averaging around 7,000 to 8,000 board feet per acre in trees 13 inches d.b.h. and larger. For the entire property the average volume per acre 13 inches d.b.h. and larger is about 3,000 board feet. This forest property is owned in connection with a small sawmill and lumber remanufacturing plant. For the past several years the forest has been conservatively cut to a 17-inch minimum breast height diameter limit.

Before the financial aspects of the property could be analyzed it was necessary to determine the productive capacity of the forest under sustained yield management. This study indicated that for the next 10 years an average cut per year of 550,600 board feet could be made without depleting any of the stands below 3,500 feet per acre. The present growth per acre without cutting averages around 325 board feet per year, while under management, with cutting taking place the annual growth per acre for the entire property would average about 240 board feet. After the first 10-year period of selective cutting and with a residual stand of 3,500 feet per acre it is estimated that for the succeeding 5-year period growth will be 400 feet per acre per year. This is in agreement with current growth determinations in present stands with 3,500 feet per acre. After 10 years the cut could probably be increased by 50 percent and maintained at that amount indefinitely.

Under the management plan drawn up for this property, costs including taxes, fire protection, administration and technical forest management would total \$1,095 per year. The total cost per thousand board feet of the timber cut during the first 10 years would be \$1.99. According to the plan not all of the growth should be cut, and the remainder, 167,300 feet per year, would be added to the forest capital. The cost per thousand feet of the total growth, therefore, would be only \$1.52 per thousand board feet.

Based on the cost of growing timber, it is evident that this company is in a position to raise stumpage and practice sustained yield. Stumpage usually sells for nearly double the growing cost in the same locality.

Hardwood Growth

That the quality of the logs increases with the age and density is shown by the summary of the red gum growth and yield study which was completed this summer. Throughout the plot establishment work of this study logs on all plots having board foot volume were graded for the purpose of determining the quality as well as the quantity of the material produced.

A system of four grades was used. Log grade 1 and log grade 2 correspond approximately to commercial log grading practice of the region. Grade 3a included logs of good quality too small for grade 2. Logs of grade 3a are primarily used for stave and veneer bolts. Grade 3 includes all other logs with 50 percent or more of their volume usable for rough structural lumber, ties, or box and crate material.

The minimum diameters of grade 1 logs were in general 18 inches and of grade 2 logs 14 inches. However, the minimum diameters were dropped 2 inches for each grade in the case of exceptionally good logs. The minimum diameters for grade 3 and 3a were likewise 10 inches with the exception of very good logs which were taken to 9 inches.

The following table shows volumes per acre obtained by averaging together all plots by age classes, and percentages of the total volume in each of the two upper log grades.

Showing volume per acre and percentages of volumes in logs of upper grades at various ages.

Age (Years)	: : Total vol- : ume per acre: :	:Percent of :total volume :in log grade 1: :	:Percent of :total volume :in log grade 2: :	: Percent of total : volume in log : grades 1 and 2 : combined. :
	Board Feet	Percent	Percent	Percent
45	5,200	0	8	8
55	6,600	2	20	22
65	12,600	4	25	29
75	19,100	9	28	37
85	26,600	12	33	45
98	32,200	15	39	54

Erosion

At Holly Springs Meginnis made an inventory of the 1933 erosion control plantings and tabulated the data in preparation for a report. A recent drought seriously affected the growth of the newly-planted stock; although survival will apparently be satisfactory. Leaf-miners, especially active during the dry weather, have done some damage to the black locust but borer injury is not pronounced except upon the older plantings. Tip-moth damage on the 1931 and 1932 loblolly pine is just beginning to show up for the season but growth has been so rapid as to considerably offset this form of injury. Some of the loblolly pines planted in gullies in 1931 are now more than 5 feet high, having grown as much as 34 inches during the current season.

Now that the experiments in erosion at Holly Springs, Mississippi, are advanced sufficiently to show results, a large part of Meginnis' time is spent in demonstrating and explaining the studies and, in particular, the gully control plantings. A field day was held July 19, at Holly Springs, and about 60 superintendents and foremen from the B.C.W. erosion camps in North Mississippi were shown the planted areas, which are actual demonstrations of the problems encountered in erosion control work. Explanations were made of the design and proper construction of brush and wire check dams and the technique of breaking down gully rims and otherwise putting the areas in shape for planting.

New Public Domain

The preliminary analysis of the delinquency data for Arkansas as a whole shows a steady increase from one year to the next in the percentage of the annual property taxes which were returned delinquent, as shown by the following figures:

Year	Property tax delinquency for the State of Arkansas.
	Percent
1927	7.1
1928	7.2
1929	7.3
1930	8.1
1931	14.3
1932	14.7

Contrary to general belief, the poorer counties with small population (generally counties having a high percent of forest land) did not show the greatest average delinquency over the 6-year period. In fact, these counties showed the least delinquency of any group, based on assessed valuation and population. Greatest average delinquency occurred in the middle group counties with population from 30,000 to 45,000 and with assessed valuations from 10 million to 15 million dollars.

Forest Survey

Outstanding in point of accomplishment during September is the completion of the growth calculations, principally the work of P. R. Wheeler, for the Bottomland Hardwood Unit in Mississippi. Based on the field work carried on during the summer of 1932 these results have been delayed because of the time required to work out a satisfactory method of analyzing the field data.

These figures indicate an annual growth on the 1,736,900 acres of forest land of a little more than 200,000,000 feet b.m., Scribner Decimal C scale, of saw log material on a growing stock of 5,088,500,000 feet b.m. in trees of saw log size. This growth is based upon the premise that the annual accretion is removed by cutting each year. It is approximately 4 percent of the present gross volume or 118 board feet per acre per year.

According to condition of stand the growth rates are as follows:

Condition	Growing stock saw timber: Growth expressed : Annual		
	size average acre.	as a percent of	growth
		the growing stock:	per acre
	Board Feet	Percent	Board Ft.
Virgin	8,620	1.5	129
Virgin culled	6,683	2.4	158
Virgin cut-over	2,661	3.1	81
Second growth	2,398	5.5	133
Second growth cut-over	2,018	5.1	104

The growth calculations also show that if no cuttings were made during the next 10-year period, the present volume of 5,088,500,000 feet, b.m. would increase to 7,572,900,000 feet, b.m. during that period, or a periodic accretion of 2,484,400,000 feet, b.m., or an average annual growth of 248,440,000 feet b.m. for the period.

The allotment of NIRA funds makes possible a great expansion of the activities of the survey in the South. The general plan is to make a line plot survey of 42,000,000 acres in the period November 1, 1933 to October 30, 1934 in the eight South Atlantic and Gulf States. The naval stores region will be covered in larger part and the hardwood bottomland region of Louisiana will be completed. In the succeeding six months it is planned to complete the naval stores belt and the unsurveyed portion of Mississippi. In addition, the survey will be extended to the Tennessee Valley where plans are now being worked out with the Tennessee Valley Authority. A field force of from 16 to 20 crews is being organized for the job.

Forest Products Pathology

Additional small-scale tests of methods of controlling sap stain in lumber and a preliminary test on the prevention of sap stain and decay in stored logs have been established. In addition, a survey of small saw mills was made to obtain information relating to their special sap stain problems and arrangements were made with a number of small mill owners for cooperation in making tests for the control of sap stain.

Forest Pathology

In a study of the influence of fire on the brown-spot needle blight of longleaf seedlings, Siggers measured the heights of 250 seedlings in an area that had been burned in March, 1931. The area selected for this study had been planted to longleaf in the winter of 1928-29, with graded nursery stock. Seedlings were three years old when the fire occurred.

The heights of 250 seedlings from the same nursery and planted at the same time were measured on an unburned area nearby. The average height of seedlings on the burned area was 8.4 inches and on the unburned it was 3.9 inches. This difference in growth is considered to be due at least in part to a reduction in the brown-spot disease that occurs when fire sweeps over an area while seedlings are still in the grass stage.

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REGION 2

The summer period of 1933 was marked by feverish activity on the part of the Experiment Station personnel. Practically all of the time was spent in the field - June and July at the Fremont Station, August on the Medicine Bow and Arapaho Forests - and little opportunity was had to compile the results of the summer's work. As a result, reference can only be made to general conclusions.

The usual spring flower counts on designated areas and trees were undertaken in the case of ponderosa pine, Engelmann spruce, and Douglas fir. Both of the former species bore heavy crops of flowers, the crop of ponderosa pine amounting to 5432 flowers per acre (an average of 96 flowers per tree), while that of Engelmann spruce averaged 6450 flowers per acre. No flowers were lost as the result of late spring frosts. Indications pointed to the fact that practically none of the flowers of the 1932 ponderosa pine crop would develop to maturity; in other words, a 100 percent failure was in prospect.

Germination tests of the seed produced in 1932 in the cone development study of ponderosa pine were made in June, and resulted in an average germination of 66.2 per cent. Only 6 cones developed from 52 flowers in the crop, a catch of approximately 12 percent. This result is in line with previous determinations that have indicated a heavy normal mortality in this species.

An interesting phase of this study concerned the progress of development of 15 flowers that were protected against pollination for one month in 1931. During the first year 12 of these developed normally so far as external appearances were concerned. However, all of the immature cones were found to have succumbed at the time of the first count on May 19, 1932, which corresponds approximately with the beginning of the fertilization period. The maximum length attained by these unfertilized cones amounted to 30 percent of average normal length.

The seed produced in 1932 by the various Douglas fir trees in the seed production study exhibited a wide range of germinability, this range being as extensive as the range in weight of the seed. The range in germination extended from 0 to 87.1 percent and the range in total numbers of clean seed per pound, from 40059 to 217959. A fairly definite inverse relationship existed between germination and the number of seeds per pound. For three lots running 90000 seed or more per pound, the average germination was only 0.6 percent; for eight lots having 60000 to 90000 seeds per pound, the average germination was 18.1 percent, and for eleven lots which contained between 40000 and 60000 seeds per pound of clean sample, the germination averaged 65.8 percent. The same relationship held true in the nine lots of 1932 seed from the Holy Cross seed trees that are also being studied in this project.

Management of the Fremont Experimental Forest (M-1)

During the summer period six plots were remeasured within the experimental forest. Two new plots, these within the spruce type of rather limited distribution, were laid out prior to cutting the timber stand to supply the seasonal fuel needs. However, to a large extent, the fuel need can be supplied by the wood from trees blown down during the gales of late May. Most of these trees are being salvaged. The total loss in windfalls will run better than two score trees. In the selection cut plot of the Douglas fir cutting method study series, four trees were levelled by the wind. Since no damage of this nature had previously occurred in the twenty years' history of these plots, the severity of the storms of the past spring may be realized.

To this windfall loss must be added that incurred by winter killing, which accounted for more than 30 trees, all located within a relatively limited area on the west side of the forest. These trees averaged considerably smaller in size than those blown down by the wind, and are being salvaged for fence posts. All in all, these extraordinary losses are expected to very nearly offset the increment of the experimental forest tract for the year.

Natural Reproduction in Douglas fir (Mc-161)

The periodic (3-year) counts of the reproduction on the four Fremont plots included in this study were made in July. Three of these plots were cut-over in 1913 and 1914, and one was left in the virgin condition to serve as a control. The cut-over plots include one that was clear cut, one upon which the cutting was of a selective nature, and one upon which a shelterwood cut was made. After twenty years the shelterwood area, from which the shelterwood trees were removed in a second or final cut in 1926, has restocked itself so much more successfully than the other cut-over plots and the control plot as to leave little room for doubt concerning the desirability of applying this method of silvicultural treatment to even-aged mature stands of Douglas fir in the Central Rocky Mountains. The reproduction on this plot not only surpasses that on the other three plots in numbers, but is also much superior in point of development. Many of the trees have now reached a height of five feet and a fully stocked second growth stand is assured. The drought years of 1931 and 1932 have materially accentuated the difference in the condition of the reproduction on the shelterwood area as contrasted with that on the selection cut and control areas, due to the absence of competition by mature residual trees. In fact, practically no new reproduction was found under the virgin stand and the prolonged drought has resulted in the almost complete elimination of the reproduction that succeeded in establishing itself since 1914.

Thinning Studies

The establishment of C.C.C. camps throughout the Forests of Colorado, Wyoming, and North Dakota has provided the opportunity for undertaking extensive thinning operations in the characteristically densely stocked sapling and small pole stands of lodgepole and ponderosa pine, also Douglas fir, within Region 2, in which growth, to a large extent, is stagnant. In drawing up specifications governing the thinning operations, emphasis was placed upon the desirability of widely spacing the residual trees, under the assumption that the present thinning will constitute the first and last thinning operation to be undertaken within, at least, most of the forested area that is now being worked over. Since the specified spacing distance, ranging from 6 to 10 feet for stands whose average height ranges between 6 feet and 25 feet, exceeds that on any of the experimental plots that exist within the region, and for which records are available, it was decided to establish a sufficient number of new plots, both within the lodge-pole pine type and in the ponderosa pine type in the Black Hills, to thoroughly determine the effect of such wide spacing upon the subsequent development of the stands and incidentally, upon the water regimen, as this is related to the amount of snow on the ground and the rate of its melting. Consequently, working plans were prepared to cover the initiation of experimental operations in both of the pine types.

In early August, three series of four plots each were laid out near the Foxpark center on the Medicine Bow Forest. Assistance was rendered by a picked crew of C.C.C. men from the Chimney Park camp under the leadership of Asst. Supt. R. F. Collins, late of the Land Economic Survey, Michigan Conservation Commission. The stands in which these plots are located are even-aged lodgepole pine, approximately 40 years old on the stump. However each series represents a different size class, size in this case being a function of density rather than of age. All of the stands are overstocked. One check plot was left in each series, while the thinning was varied to leave one plot spaced according to the standard administrative specifications, with another less widely spaced, and a third, even more widely spaced. The details of establishment are as follows:

<u>Series</u>	<u>Average Ht. of Residual Stand (ft.)</u>	<u>Approx. Average d.b.h. of Re- sidual Stand (inches)</u>	<u>Approx. Spacing Dis- tance on Three Thinned Plots (ft.)</u>
N	6 to 12	1	$5 \times 5' - 7\frac{1}{2} \times 7\frac{1}{2}' - 10 \times 10$
O	12 to 25	3	$7\frac{1}{2} \times 7\frac{1}{2}' - 10 \times 10 - 12\frac{1}{2} \times 12\frac{1}{2}$
P	25 to 45	5	$10 \times 10 - 12\frac{1}{2} \times 12\frac{1}{2} - 15 \times 15$

The work of calipering and thinning these plots is still under way under Mr. Collins' direction.

Late in August, a fourth plot was added to the Meadow Creek group of lodgepole pine thinning study plots on the Arapaho Forest in Northern Colorado, at the time when the original three, one of which was established in 1911 and two in 1924, were remeasured. The new plot is expected to provide information on the effect of wide spacing as employed in C.C.C. practice, namely 11×11 , in 60 to 70 year old pole stands, as contrasted with the effect of more conservative spacing, $8 \times 8'$ and $5 \times 5'$, as exemplified on the two other thinned plots.

The plans have been laid to establish two or three series of plots in the Black Hills ponderosa pine type in September or October. Such plots are badly needed, in view of the fact that, with the exception of the four plots in Block H, laid out within the Nemo center in 1931, in a thrifty but overstocked 60-year old pole stand, no other permanent sample plots exist within thrifty, immature stands of ponderosa pine in which the result of thinning may be expected to yield the greatest return in the way of accelerated growth following the removal of suppressed and intermediate trees.

While on the Arapaho Forest, Roeser remeasured the three 1922 spruce type cutting plots, which were last remeasured in 1928. C.C.C. help was used in accomplishing this remeasurement. No statistical results are, as yet, available. The most obvious phenomenon noted on the ground was the large number of trees, chiefly alpine fir, that were killed since 1928, especially on the lightly cut-over stand, by the work of porcupines and possibly squirrels. A large proportion of the trees succumbed following the girdling of most of their branches just beyond the stem of the tree. While it appears that biotic activity was more pronounced during the last five years than in previous periods, it is also possible that the relative heavy mortality may, in part, be due to the combined effect of rodent injury and drought.

The three San Juan cutting degree study plots in ponderosa pine were remeasured for the second time. Tentative conclusions indicate that growth per individual tree on this area exceeds similar growth on any other sample plots within the Region. Under controlled grazing, the reproduction is also growing very rapidly, but its distribution is spotty, and confined mostly within the limits of oak brush clumps.

The erosion control operations on the north end of Coyote Park and in the Rio Blanco drainage were inspected. Considerable work has been done, and while progress is slow, valuable information is being obtained on the most desirable and adaptable structural features governing the construction of check dams in the local type of "sugar" soil. Included among these features are chinking of log dams, central spillways, double foundation logs and long oak-brush and rock aprons.

On the Montezuma Forest, a CCC side camp was established on Barlow Creek above Rico for the purpose of cutting the stand on the three spruce type plots established in 1930 to determine the best method of cutting these stands for pulpwood production from the standpoint of yield and future growth. Prior to starting the felling operations, the plots were remeasured. Coincident with felling, a volumetric study will be conducted.

A brief stop was made on the Medicine Bow Forest to inspect the work done by Ass't Sup't R. F. Collins' crew in the task of establishing three blocks of thinning plots in the Foxpark region following the initiation of the project by Research in August. The job was found not only to be almost completed, but also very well done; in fact, it is believed that these plots will establish as high a standard of technical perfection as they should establish one for the attainment of an objective of silvicultural significance for the Region.

The month came to an end on the Bighorn Forest during the remeasurement and standardization of the two three-plot groups of pole and sapling thinning plots established administratively in 1927-1928 on the Buffalo District of the Forest. The handling of this work was greatly facilitated by the employment of a technical CCC foreman, F. Newcomer, and two picked crews of CCC enrollees. It is not expected that the thinned pole stand plots will yield information of any great importance, other than to substantiate what has already been learned from the thinning of mature stands in the lodgepole pine type, namely that mortality and windfall are heavy and stimulation of growth more or less inappreciable. So far as the thinned sapling stand plots are concerned, they tie in fairly well with the new line-up of thinning investigations and should by all means be retained for continued study.

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